

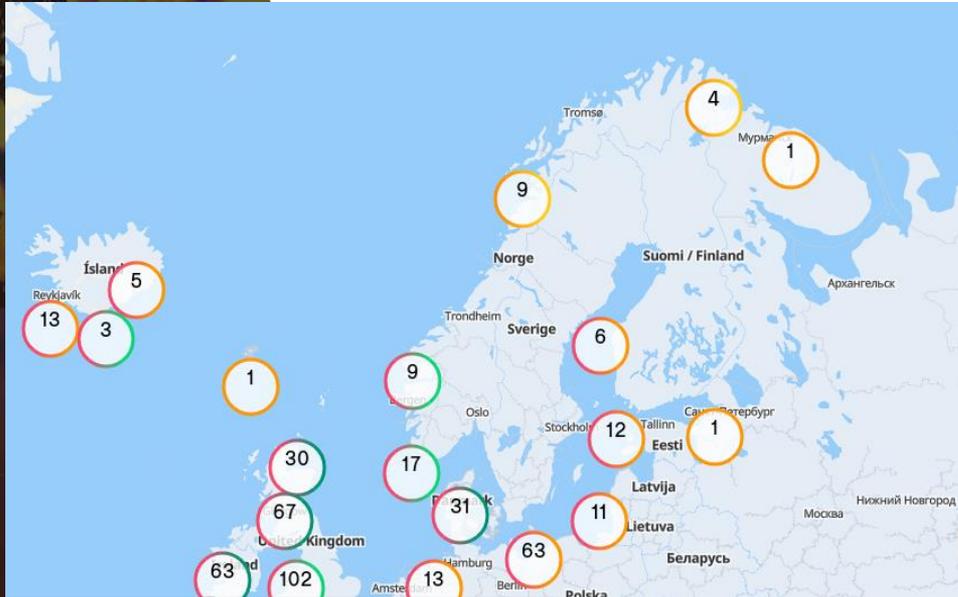
# Verification and value of forecast for water sports or ... the waves behind the numbers



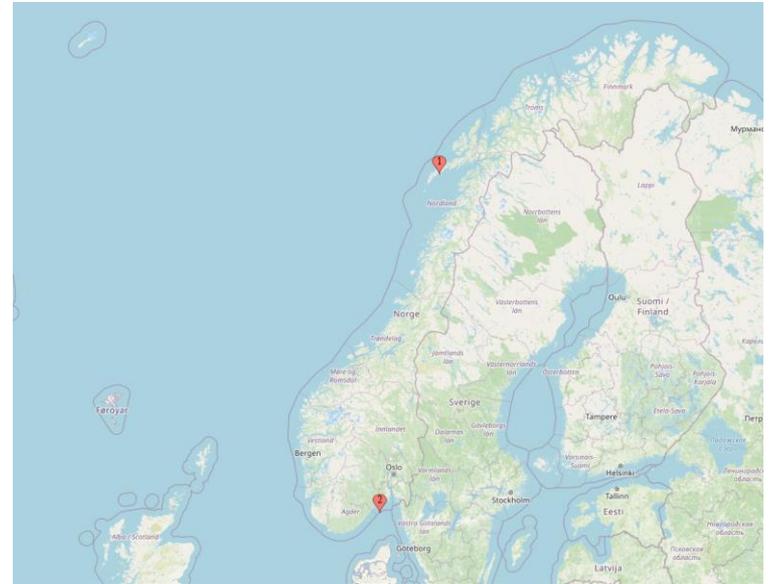
# Northern Europe surfing communities

characteristics:

- very dedicated forecast users, only in Norway 5000+
- best season autumn-spring,
- long period waves (“ground swell”) often impacted by frequent local storms (wind swell)

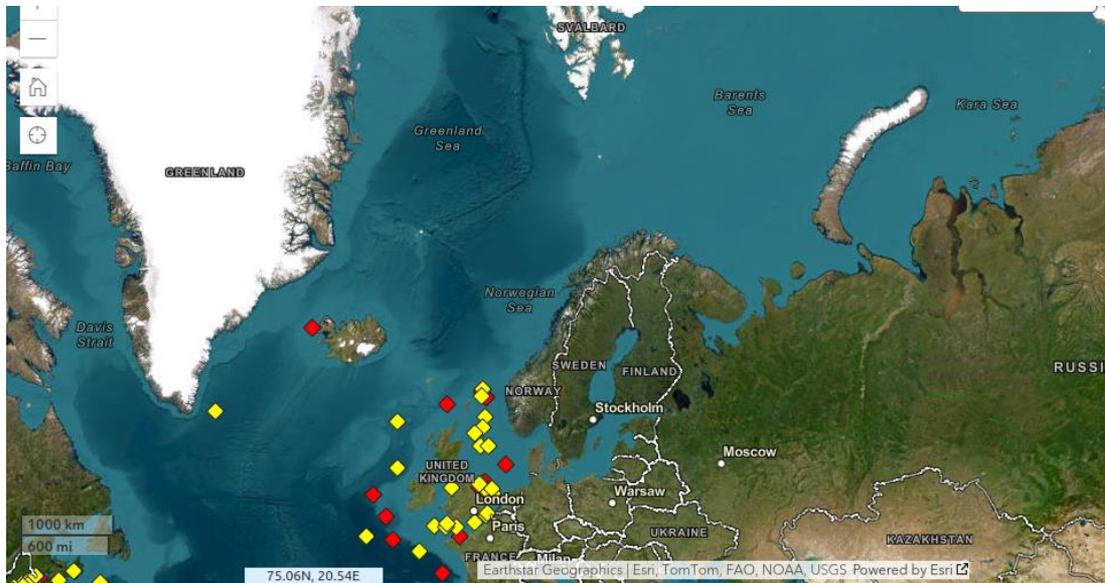


Nordic region major surf spots

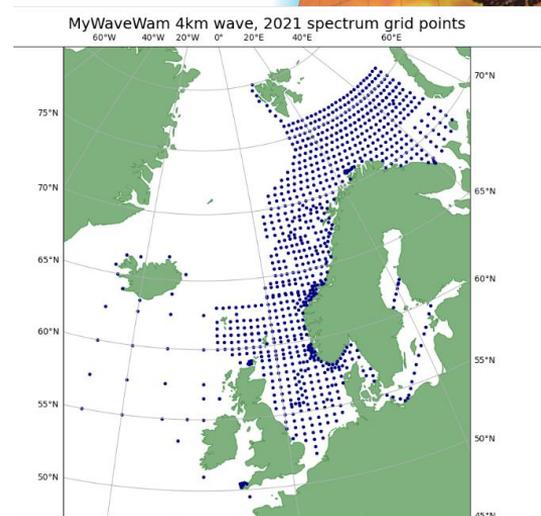


beaches analysed in presentation

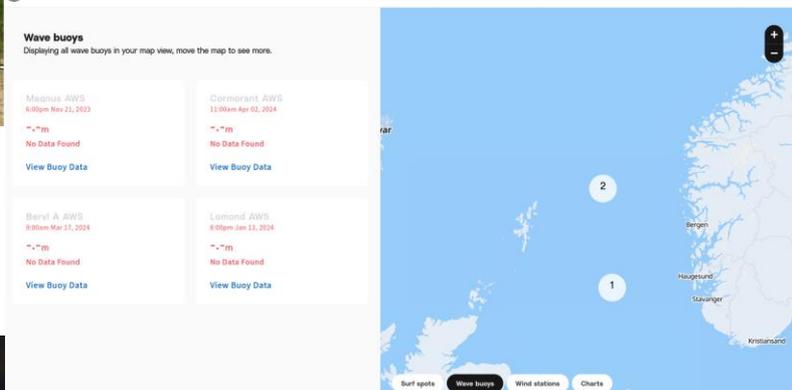
# Available real time data



wave buoys location North Atlantic,  
source: National Data Buoy Centre



Grid points for which spectrum is computed,  
archive WAM 4 km met.no

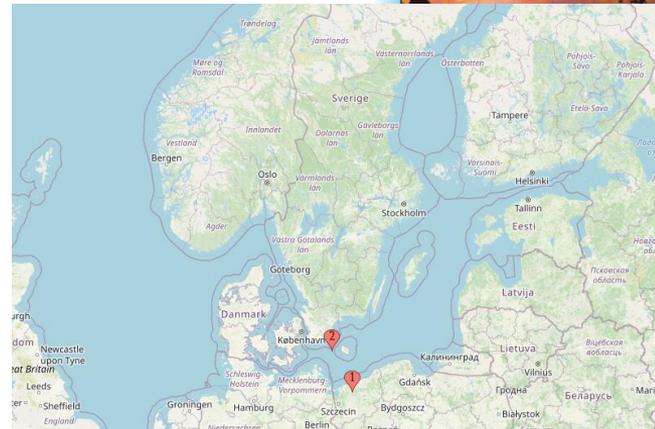


# Understanding the needs: open water swimmers

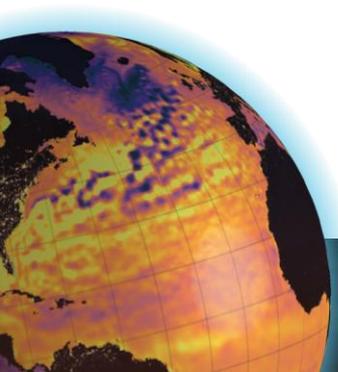
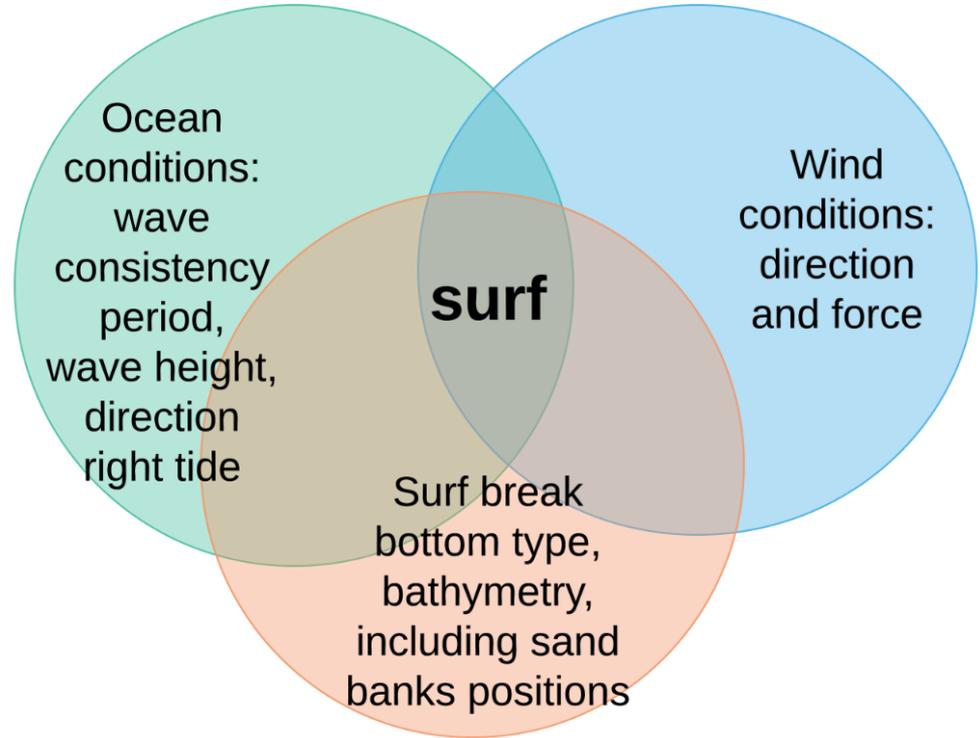
long forecast lead time: > 39h

swimmer pace up to: 1:40/100 m - 3.6 [km/h](fast)

2 failed attempts due to unpredicted opposite  
current

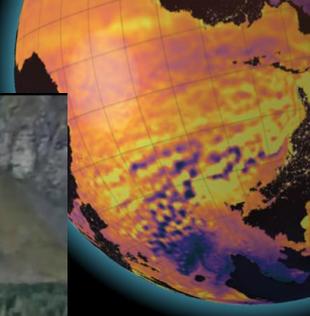


# Understanding surf forecast needs



9 April 2021, 3pm UTC +2, 1300 kJ

30 Aug 2020, 5pm UTC + 2, 495 -847 kJ



# Hs: 1.8 -2.3 [m] Tp: 9-11[s], 325°

3pm	1.5-2.4	FAIR TO GOOD	2.3m 11s			13 <sup>16</sup> kph
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3pm	1.2-1.8	FAIR	1.8m 9s	0.4m 8s	12 <sup>17</sup> kph
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6pm	1.5-2.1	FAIR	2.2m 11s	0.3m 8s	15 <sup>22</sup> kph
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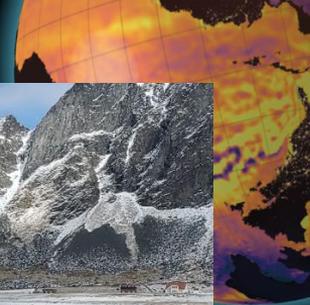


2020-2021 Surfline archive, Lola model  
photos: author

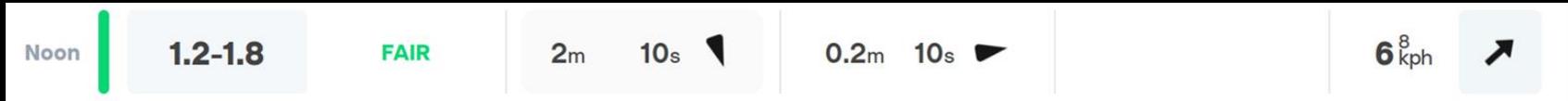
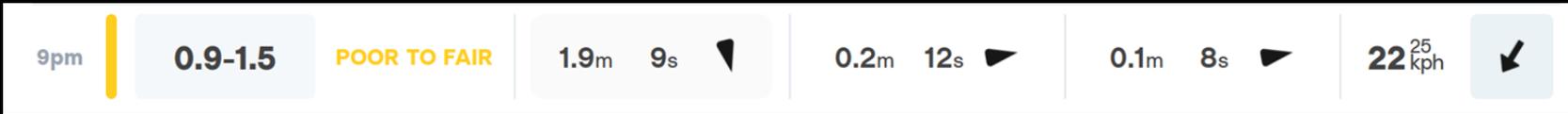


2 May 2021, 9 pm, UTC +2, 418 kJ

13 April 2021 2 pm, UTC +2, 625 kJ



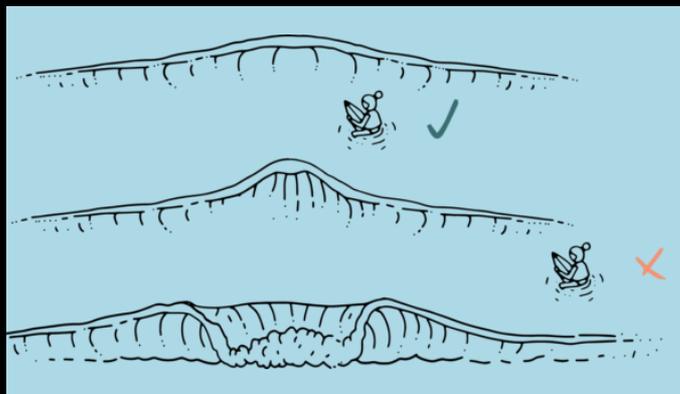
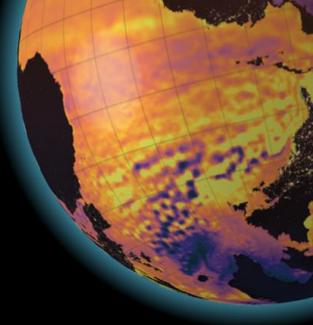
# Hs 1.9 - 2[m], Tp 9-10 [s], 341°-347°



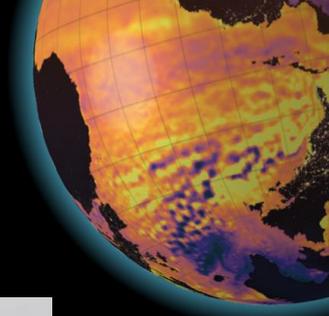
Surfine archive 2020-2021, Lola model  
photos: author

# Understanding surfing forecast needs:

predictability of breaking wave spot



# Primary need - quality of waves



clean/glassy waves

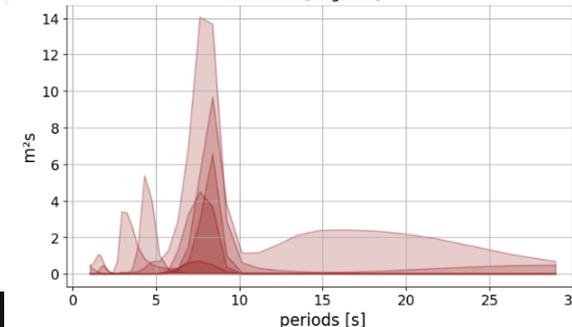
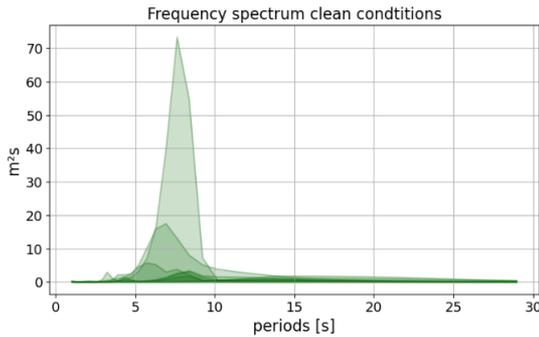
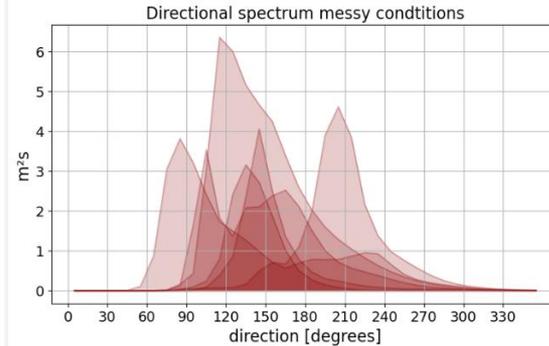
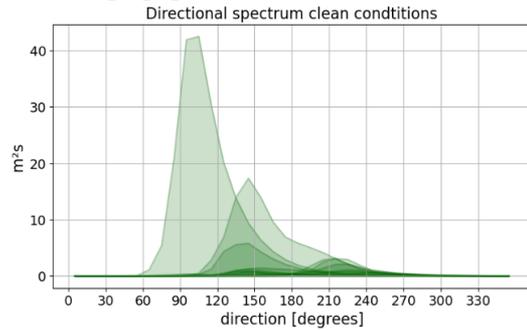
messy/fun/choppy

# Can clean vs messy conditions be classified based only on forecast data?

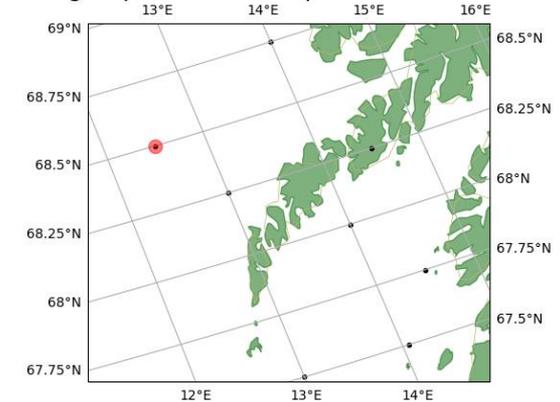
## Quantifying the “quality waves”

6+10 datasets (2020-2021) photos compared to

spectrum forecast: MyWaveWam 4km, 1h step, run every 6h



Closest grid point with 2D spectra data 51 km away

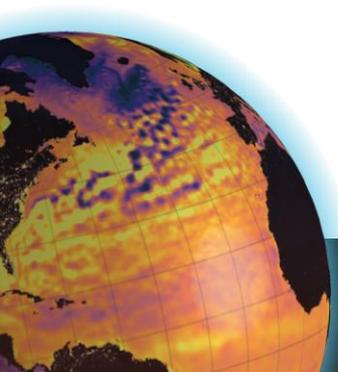


# The need of in situ measurements/live data:

- the attempt to quantify the good conditions
- the classic evidence is surf report/photos - human observations
- lack of (open) essential data beside altimetry and very remote wave buoys

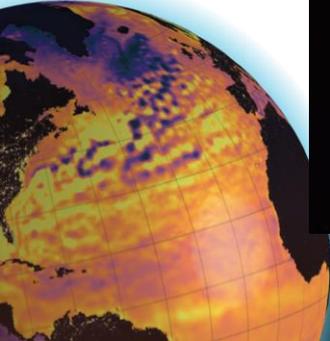
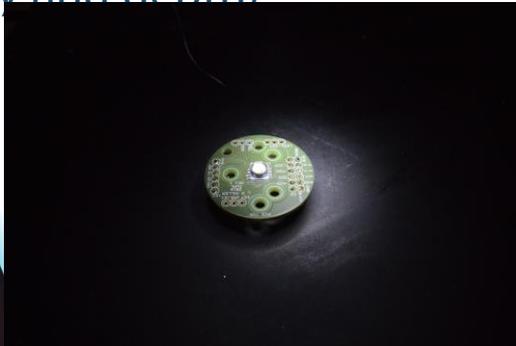
## open source hardware

- user-assembled microcontroller based sensors
- low power, low material cost, may be work consuming
  - low cost deployment and retrieval process
  - acceptable accuracy



# bottom mounted pressure logger

- OWHL project by Luke Miller et al from San Diego State University
- piezoelectric effect
- indirect point measurement of pressure (hydrostatic and dynamic) at the deployment point
- atmospheric pressure need to be measured
- unlike IMU based sensors allow for registration of tides
- software correction for wave attenuation and shallowness effect (function of frequency and depth)



# sensor validation

hydrostatic tests

wave tank linear waves laboratory tests

tide measurements comparison to tide station

comparing to commercial SBE 26 Seagauge (2020 Lyman et al.)

possible unknown factors:

temperature effect (oil bladder elasticisticity)

effect from mooring and housing

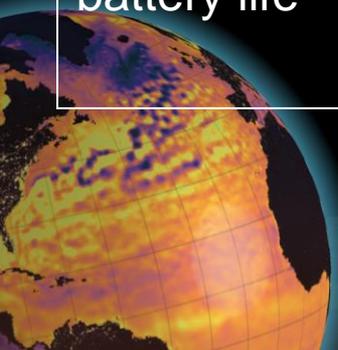
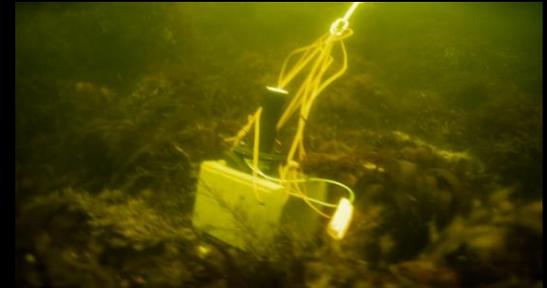
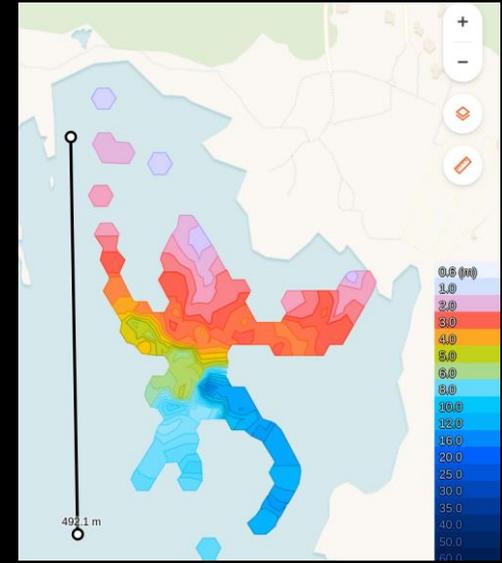
effect of vegetation/sand

wave attenuation correction algorithm



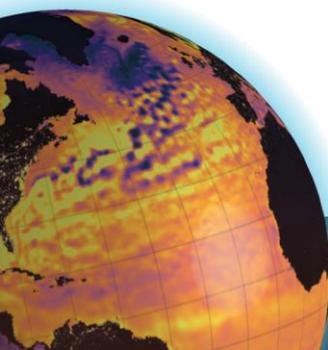
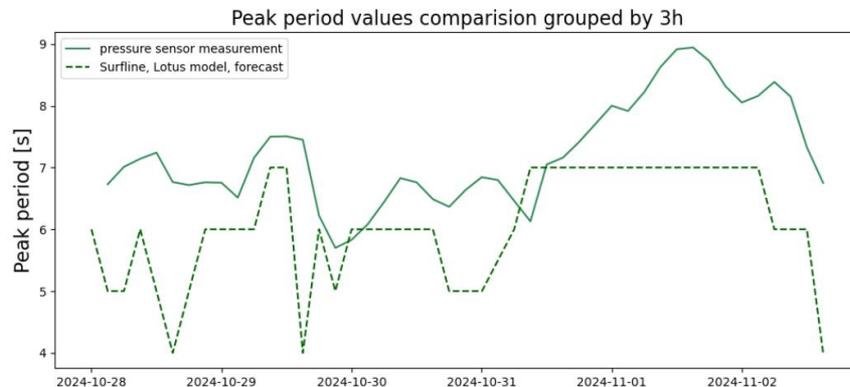
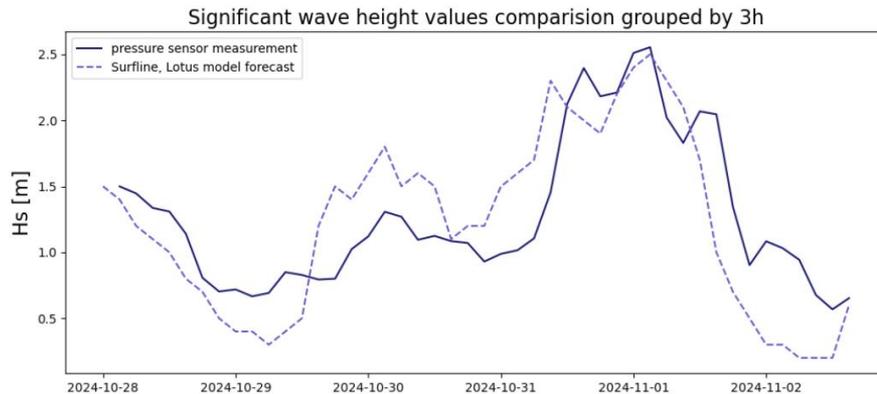
# sensors deployment:

depth	~7 [m]
tide range	0.3 [m]
sampling frequency	4 [Hz]
estimated accuracy	0.04[m] 40 [mbar]
battery life	~6 months



# example of 1 week data

# compared against Surfline Lotus model forecast

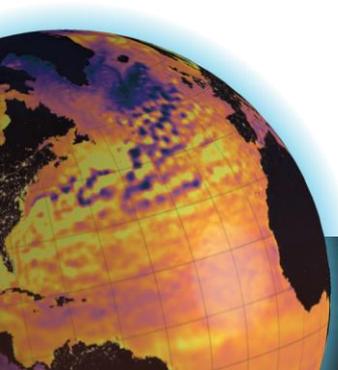


# Key takeaways

- What are the reasonable expectations towards forecast accuracy about unexpected surface currents?
- Open access to open ocean/weather data is very important

## Future work

- data driven recognition of optimal conditions



# SYM POSIUM OP' 24

ADVANCING OCEAN PREDICTION  
SCIENCE FOR SOCIETAL BENEFITS

# Thank you!



"Forecasts possess no intrinsic value.  
They acquire value through their ability to influence the decisions  
made by users of the forecasts."

meteorologist Allan H Murphy

